



DEPARTMENT OF DEFENSE ELECTROMAGNETIC
COMPATIBILITY PROGRAM (AIR FORCE ELECTROMAGNETIC
ENVIRONMENTAL EFFECTS PROGRAM)

This supplement implements and extends the policy of Department of Defense (DoD) Directive 3222.3, *Department of Defense Electromagnetic Compatibility (EMC) Program*, August 20, 1990. The DoD directive is printed word-for-word in **boldface type**, without editorial review. Air Force supplementary material is printed in regular type and indicated by "(AF)." This supplement describes Air Force responsibilities under the directive, and establishes the Air Force Electromagnetic Environmental Effects (E³) Program (E³P). The objective of the E³P is to achieve the electromagnetic compatibility (EMC) of all ground, air, and space electronic and electrical equipment, subsystems, and systems. This supplement identifies the Air Force Frequency Management Agency (AFFMA) as the executive agent for the E³P, assigns the key role for management of the E³P to the Air Force Materiel Command (AFMC), and requires important participation by other Air Force major commands (MAJCOM) and field operating agencies (FOA). This supplement applies to Air Force activities including US Air Force Reserve and Air National Guard units and members that plan, design, develop, lease, procure, select sites for, install, operate, modify, or maintain ground, air, and space electronic, electrical, or telecommunications equipment. It pertains to any subsystem, system, or other ground and aerospace equipment that is susceptible to, or capable of creating, EMI, through direct or indirect insertion of electromagnetic energy into the frequency spectrum.

SUBJECT: Department of Defense Electromagnetic Compatibility Program (EMCP)

References: (a) DoD Directive 3222.3, "Department of Defense Electromagnetic Compatibility Program," July 5, 1967 (hereby canceled)

(b) DoD Directive 5160.57, "Electromagnetic Compatibility Analysis Center (ECAC) September 23, 1966 (hereby canceled)

(c) DoD Directive 4120.3, "Defense Standardization and Specification Program," February 10, 1979

(d) DoD Directive 4650.1, Management and Use of the Radio Frequency Spectrum," July 24, 1987

(e) DoD Directive C-3222.5, "Electromagnetic Compatibility (EMC) Management Program for SIGINT Sites (U)," April 22, 1987

(f) "Manual of Regulations and Procedures for Federal Radio Frequency Management," authorized by U.S. Department of Commerce, May 1989 Edition (with revisions for September 1989 and January 1990)¹

A. REISSUANCE AND PURPOSE

This Directive reissues reference (a) to:

1. Update DoD policy on integrated EMCP to ensure EMC of all military electronic and telecommunications equipments, subsystems, and systems during their conceptual, design, acquisition, and operational phases.

2. Assign specific and joint responsibilities to DoD Components for leadership in the following EMCP areas:

a. Data base and analysis capability.

¹Available through the U.S. Department of Commerce, National Telecommunications and Information Administration, Room 1605, 14th and Pennsylvania Avenue, NW, Washington, DC 20230.

- b. Standards and specifications.
- c. Education for EMC.
- d. Design.
- e. Doctrine, tactics, techniques, and procedures.
- f. Operational problems.
- g. Test and validation.

3. Provide the following EMCP objectives:

a. Achievement of EMC of all electronic and electrical equipments, subsystems, and systems that are produced and operated by DoD Components. Operational compatibility with the equipment, subsystem, or systems when used in their intended environment is part of, and the main focus of, that objective.

b. Attainment of built-in design compatibility instead of after-the-fact remedial measures.

c. Fostering of common DoD-wide philosophies, approaches, and techniques in the design, production, test, and operation of military telecommunications equipments.

4. Incorporate DoD Directive 5160.57 (reference (b)) into this Directive to specify the functions, responsibilities, operational relationships, and fiscal arrangements for the ECAC.

5. (Added)(AF) Purpose. This supplement implements and expands the policy of DoD Directive 3222.3 and establishes policy for the Air Force E³P.

B. APPLICABILITY

1. This Directive applies to the Office of the Secretary of Defense (OSD); the Military Departments; the Chairman, Joint Chiefs of Staff and Joint Staff; the Unified and Specified Commands; the Inspector General, Department of Defense (IG, DoD); the Defense Agencies; and the DoD Field Activities (hereafter referred to collectively as "DoD Components"). The term "Military Services," as used herein, refers to the Army, Navy, Air Force, and Marine Corps.

2. (Added)(AF) Applicability and Scope. This supplement applies to all levels of command that plan, design, research, develop, test, acquire, lease, procure, select sites for, install, modify, maintain, logistically support or operate Air Force ground, air, and space electrical and electronic equipment, subsystems and systems.

C. DEFINITIONS

1. **Electromagnetic (EM) Compatibility (EMC)**. The ability of telecommunications equipments, subsystems, and systems to operate in their intended operational environments without suffering or causing unintentional unacceptable degradation because of EM radiation or response.

2. **Telecommunication**. Any transmission, emission, or reception of signs, signals, writings, images, sounds, or information of any nature by wire, radio, visual, or other EM systems.

3. (Added)(AF) Terms Explained. (See attachment 1).

D. POLICY

1. Policy guidance for the EMCP and the ECAC shall be provided jointly by the Assistant Secretary of Defense (Command, Control, Communications, and Intelligence) (ASD(C3I)) and the Chairman, Joint Chiefs of Staff (CJCS), or designees.

2. EMCP applies to the conceptual, design, acquisition, and operational phases for all military electronic and telecommunications equipments, subsystems, and systems. The EMCP includes the following areas:

a. Data Base and Analysis Capability. Acquisition of effective data bases and mathematical and statistical tools for EM analysis of any telecommunications component, circuit, equipment, subsystem, system, environment, concept, or doctrine and the ability to apply those tools to predict, prevent, and correct incompatibilities. That shall require:

(1) A DoD-wide data collection and verification plan to ensure complete and current data bases adequate to describe any probable telecommunications environment in sufficient technical and operational detail.

(2) Common data processing and analytical techniques to provide rapid and timely summaries of data and analyses of equipments within known or expected environments, site selection and evaluation, analyses of concepts and doctrine for the use of telecommunications equipment in support of military operations, and solution of existing EM operational problems.

b. Standards and Specifications

(1) Adequate and useful military standards and specifications for design, development, procurement, production, test, and measurement related to EMC shall be developed. Retrofits, modifications, and upgrades of fielded telecommunications equipments, systems, and subsystems shall be subject to that process, consistent with projected modification costs and expected operational life of the equipment or system, and shall be done in accordance with DoD Directive 4120.3 (reference (c)).

(2) Adherence by all DoD Components to all DoD EMC standards and specifications shall be mandatory for the applicable operational telecommunications equipments, subsystems, and systems, unless duly waived.

(3) Where required standards and specifications for EMC either do not exist or need correction, they shall be developed or updated promptly.

(4) Authority for waiver control over any of the EMCP standards and specifications shall rest at a level determined by the DoD Component concerned. That authority shall be delegated with careful discretion to prevent evasion of the EMC standards and specifications. Notification of all waiver actions must be provided concurrently to the CJCS, or designee of EMCP issues, for review and maintenance of records.

(5) (Added)(AF) All Air Force activities will apply appropriate E³ standards and specifications. The applicable standards will be met unless specific operational waivers are granted in writing by HQ USAF/XO. Requests for waivers must be accompanied by an analysis of the operational mission impact of each waiver.

(6) (Added)(AF) Requests for waiver of EMC standards, specifications, and tests by system development and acquisition offices during Research Development Test and Evaluation (RDT&E) and acquisition activity must be sent to HQ USAF/XO and HQ USAF/SC for their review and comment on the operational impact, before being sent through SAF/AQK to SAF/AQ for approval or disapproval. All waivers must be accompanied by an EMC analysis of the system detailing the impact of granting the waiver.

(7) (Added)(AF) Reference. SD-2, *Buying Nondevelopmental Item Program (NDI)*, October 1990, paragraph 6.5. The suitability of nondevelopmental item (NDI) for a particular application must be assessed based on the criticality of the application, electromagnetic environments present, other equipment in the installation and available electromagnetic environments present, other equipment in the installation and available electromagnetic interference test data. Testing according to military standards may be necessary for an adequate determination to be made. The NDI must also be electromagnetically compatible with existing operational equipment and systems. The fact that an NDI may already be accepted in the commercial marketplace does not ensure electromagnetic compatibility requirements are met.

c. Measurement Techniques and Instrumentation. DoD Components shall maintain the capability to determine EM interference (EMI) effects and verify EMC through measurement. Basic electronic and electrical engineering tools and automated measurement techniques, rather than special purpose instrumentation, shall be used when available.

d. Education for EMC. Awareness of the effects of EMC deficiencies on the part of all DoD personnel concerned with the design, development, production, test, operational use, and maintenance of military electronic and telecommunications equipment shall be attained through:

(1) Training of designers and engineers in the design and production methods and techniques for achieving EMC.

(2) Training of operating and maintenance personnel in the identification of EMI in preparation for developing field techniques to optimize EMC.

(3) Emphasis on EMC considerations as a portion of basic electronic and electrical engineering techniques.

(4) Inclusion of EMCP within the training curricula for acquisition managers.

e. Design. Emphasis shall be placed on designing systems, from their conception, to achieve desired EMC performance levels. System design requires the selection of those techniques, circuits and components during the research, development, test, and evaluation (RDT&E) phases necessary to achieve compatible system operation.

f. Doctrine, Tactics, Techniques, and Procedures. EMC and EMI factors in the field employment of telecommunications equipments, subsystems, and systems shall be considered in the development of doctrine, tactics, techniques, and procedures. To minimize the impact of EMI factors shall require:

(1) Analysis for EMC of all current and proposed doctrine, tactics, techniques, and procedures in the earliest possible timeframe to ensure that they shall not be invalidated by degradation of sensors or communications equipment from mutual or external interference.

(2) Consideration of EMC factors in war-gaming to ensure awareness of the total EM environment in the evolution of new doctrine, tactics, techniques, and procedures.

g. Operational Problems. Development of a capability for detecting, reporting, solving, and correcting current timeframe operational EMC problems shall require:

(1) Procedures for detecting and channels for reporting EM incompatibilities and EMI, which degrade combat effectiveness in the field. (Added)(AF) AFI 10-707, *Spectrum Interference Resolution* (formerly AFR 55-3), establishes Air Force policy and procedures for detecting, reporting, and correcting EM incompatibilities and EMI.

(2) Application of existing measurement and analysis techniques to identify the sources of the problems and determine corrective action.

(3) Procedures for rapid implementation of required corrective action.

h. Test and Validation. Field engineering test facilities and testing in the intended operational environments are required to verify predicted performance and to establish confidence in EMC design, based on standards and specifications, and in EMC analysis methodology, thus providing:

(1) Problem parameter measurements.

(2) Evaluation of EMC analysis and predictions in appropriate (real or emulated) environments.

3. (Added)(AF) Department of the Air Force will maintain an E³P in conjunction with the DoD EMCP.

E. RESPONSIBILITIES

1. The Assistant Secretary of Defense (Command, Control, Communications, and Intelligence (ASDC3I)) and the Chairman, Joint Chiefs of Staff (CJCS), or designees, shall be responsible, jointly, for:

a. Oversight of the EMCP.

b. Providing policy guidance and direction to the ECAC.

c. Providing specific direction, as necessary, to ensure a well-coordination and current EMCP.

d. Reviewing ECAC's EMCP plan for providing EMC analysis capabilities and use of the EMC data bases, annually, and, if required, designating DoD Components to carry out specific requirements of that plan.

e. Ensuring that adequate data base and analysis support is provided by the ECAC to the DoD Components having those responsibilities. The functions of frequency management have a strong influence on operational compatibility, and require data base and analysis support. DoD Directive 4650.1 (reference (d)) assigns responsibilities in this area.

2. The Chairman, Joint Chiefs of Staff (CJCS), or designee, shall be responsible for:

a. Collection of information for EMC data bases. Those collection efforts should especially consider EMC program needs for spectrum signatures, characteristics, locations, and operating plans for newly fielded or modified systems.

b. Submission of doctrine, tactics, techniques, and procedures for joint operations to the ECAC for analysis of EMC impact.

c. Developing and implementing procedures and channels for detecting and reporting current joint operational EMC and EMI problems.

3. The Director, Electromagnetic Compatibility Analysis Center (ECAC), shall be responsible for:

a. The DoD joint EMC program that shall include:

(1) Development and maintenance of a coordination plan for providing EMC analysis capabilities and use of the EMC data bases.

(2) Development, maintenance, and distribution of EMC data bases and EMC analysis models.

(3) Providing technical and/or operational EMC analysis support to the ASD(C3I), the CJCS, and the Military Communications-Electronics Board (MCEB).

b. The sponsored EMC program that shall include:

(1) Providing EMC analysis on a reimbursable basis to DoD Components developing or operating telecommunications equipment.

(2) Providing EMC analysis on a reimbursable basis to other departments of the U.S. Government and to others, as authorized by the ASD(C3I) (e.g., foreign governments and industry under contract to the U.S. Government).

NOTE: In furtherance of that sponsored program, the ECAC is authorized to communicate directly with all of the DoD Components and other non-DoD activities.

4. The Secretary of the Air Force shall:

a. Be designated as the administrative agent for ECAC.

b. Program, budget, and finance the joint EMC program at the ECAC, described in paragraph E.3.a., above. The joint EMC program budget and changes to the joint EMC program budget (e.g., reprogrammings) shall be coordinated with the ASD(C3I) and the CJCS, or designees.

c. Appoint the Director, ECAC, who shall be a Colonel, subject to approval by the ASD(C3I) and the CJCS, or designees.

d. (Added)(AF) AFFMA/SCM will be the office of primary responsibility (OPR) for the Air Force E³P. Specific responsibilities within the Air Force for the DoD EMCP areas are listed in supplements to paragraph 7.

5. The Secretaries of the Military Departments shall:

a. Provide a suitably qualified field grade officer to serve as a Deputy Director, ECAC. The responsibilities of the Deputy Directors at ECAC are to:

(1) Assist the Director, ECAC, in providing quality EMCP support to all users.

(2) Monitor the status of Service-related projects.

(3) Assist the spectrum management offices of each respective Service.

(4) (Added)(AF) The Air Force Deputy at ECAC (ECAC/CF) is responsible for technical support to the AFFMA in support of the Air Force's E³P.

b. Provide such personnel to ECAC, as designated for that Service by the Joint Staff Table of Distribution (JTD).

6. The Director, National Security Agency (NSA), shall be responsible for the signals intelligence (SIGINT) portions of the EMCP, as assigned by DoD Direction C-3222.5 (reference (e)).

7. The Heads of DoD Components shall be jointly responsible for leadership in each of the following EMCP areas:

a. Data Base and Analysis Capability

(1) Ensuring that ECAC data bases are complete and current for equipments, subsystems, and systems that are acquired, developed, or operated by their respective DoD Components.

(2) Using ECAC capabilities maximally, rather than developing duplicate data bases or EMC analysis tools, The need for separate data bases should decrease as communications between data processing systems improve.

(3) Developing new data bases and analytical techniques when required for intra-DoD Component problems that, with minimum modification, may be exchanged with and used by the DoD Components.

(4) (Added)(AF) When necessary the Air Force organizations will develop analytical capabilities and keep the related data bases required for EMI and EMC analysis. Air Force organizations will coordinate these analytical capabilities and data bases with AFFMA and ECAC to minimize duplication and costs.

(5) (Added)(AF) Each Air Force MAJCOM and FOA will provide adequate electromagnetic compatibility and spectrum management data via the allocation and assignment process on all systems developed, acquired (purchased), or operated within the organization according to AFI 33-106, volume. 9, *Radio Frequency Spectrum Management* (formerly AFR 700-14).

b. Standards and Specifications

(1) Developing and maintaining a complete range of component, circuit, equipment, subsystem, and system EMC standards. Related standards for prediction, measurement, and validation of EMC shall be included.

(2) Ensuring that all specifications for telecommunications equipment cite appropriate EMC standards.

(3) (Added)(AF) AFMC will prepare, review and coordinate E³ standards and specifications for Air Force use and will review and coordinate with other agencies in the development of common E³ standards and specifications.

(4) (Added)(AF) Any Air Force organization wanting to use a device or system intended to emit radio frequency energy must ensure the device or system has already been allocated frequencies through the Joints Chiefs of Staff Military Communications Electronics Board (JCS/MCEB) allocation process. If not, then the acquiring unit must process a DD Form 1494, **Application for Equipment Frequency Allocation**, before the development, testing, purchase, lease, rent or use of this device.

(5) (Added)(AF) The Air Force Surgeon General, through the Director of Professional Affairs and Quality Assurance (HQ USAF/SGP) coordinates on electromagnetic radiation bioeffects research, establishes personnel exposure standards and provides guidance for evaluating and controlling E³ health hazards in AFOSH Standard 161-9, *Exposure to Radio Frequency Radiation*.

(6) (Added)(AF)AFMC will acquire and employ measurement techniques and instrumentation with the sensitivity, accuracy, range and stability necessary to provide valid EMI data on Air Force systems.

c. Education for EMC

(1) Ensuring that properly balanced emphasis on EMC is included in all formal courses in design, maintenance, and operation of telecommunications components, circuits, equipment subsystems, and systems conducted within their organization.

(2) Maintaining current handbooks describing the most effective techniques for meeting the standards for EMC. Adoption of other DoD Component handbooks, which are adequate, is encouraged.

(3) Ensuring adequate participation by appropriate members of their staff in symposia, conferences, and other professional activities of the industry organizations and technical societies concerned with EMC and electronic engineering.

(4) (Added)(AF) Air Force personnel must develop an awareness of the need for EMC and techniques to ensure EMI control. This will be done through training of Air Force personnel whose duties are to plan, design, research, develop, test, acquire, lease, procure, select sites for, install, modify, maintain, logistically support or operate Air Force ground, air, and space electrical and electronic equipment, including telecommunications.

(5) (Added)(AF) All MAJCOMs will participate in EMC training for the categories of personnel listed below. Specifically, Air Education and Training Command will plan and conduct, based on requirements submitted according to AFI 36-2201, *Developing Military Training Programs* (formerly AFR 50-9), formal EMC and E³ training.

(a) (Added)(AF) Plans and requirements personnel.

(b) (Added)(AF) Designers and engineers.

(c) (Added)(AF) Operating and maintenance personnel.

(d) (Added)(AF) Commanders' and managers'. EMC training will include the following:

(e) (Added)(AF) On-the-job training relative to EMC, as applicable.

(f) (Added)(AF) Training for designers and engineers in the design and production methods and techniques for achieving EMC.

(g) (Added)(AF) Training for operating and maintenance personnel in the identification of EMI in preparation for developing field techniques to optimize EMC.

(h) (Added)(AF) Emphasize EMC considerations as a portion of basic electronic and electrical engineering techniques.

(i) (Added)(AF) Include the DoD EMCP and the Air Force E³P within the training curricula for acquisition managers.

(6) (Added)(AF) Air Force Institute of Technology, and the Air Force Deputy at ECAC will incorporate EMC program training objectives into related EM and EMC engineering courses.

d. Design. Emphasizing EMC in RDT&E of telecommunications equipments, subsystems, and systems and ensuring exchange of information regarding results of those efforts.

(1) (Added)(AF) AFMC will also conduct continuing research and systems analyses on which to base recommendations for increasing the efficient use of the electromagnetic spectrum and enhancing the EMC of electrical, electronic, and telecommunications systems. AFMC will ensure wide dissemination of the research and analysis results, to include AFFMA and ECAC/CF.

(2) (Added)(AF) Air Staff program element monitors (PEM) will include E³P objectives and any special E³ requirements in their program management directives (PMD). Funding for applicable E³ objectives will be included in the POM as part of the system life-cycle cost.

e. Doctrine, Tactics, Techniques, and Procedures. Providing proper EMC-impact consideration in the formulation of their intra-DoD Component doctrine, tactics, techniques, and procedures.

(1) (Added)(AF) EMC, EMI, and spectrum management factors in the field employment of ground, air, and space electrical, electronic, and telecommunications equipment, subsystems, and systems will be considered in the development of Air Force doctrine, tactics, techniques, and procedures.

(2) (Added)(AF) Each Air Force activity will include available information on the electromagnetic environment in mission need statements and other requirements documents. This information will be used in analyses of electrical, electronic, and telecommunications equipment employment concepts and doctrine before acquisition.

(3) (Added)(AF) HQ USAF/XO will review requirements and planning documents in the earliest possible timeframe to evaluate the impact of proposed new or modified electrical, electronic, and telecommunications in equipment on existing systems and all intended operational electromagnetic environments.

(4) (Added)(AF) Each Air Force MAJCOM and FOA must develop and implement procedures and channels for detecting, reporting, solving, and correcting Air Force EMC problems. This effort will also provide feedback to aid in the development of standards, design concepts, doctrine, education, and analytical elements of the E³P.

(5) (Added)(AF) Each Air Force activity will include consideration of EMC and spectrum management factors in wargaming to ensure awareness of the total environment in the evolution of new doctrine, tactics, techniques, and procedures.

f. Operational Problems. Developing and implementing procedures and channels for detecting, reporting, solving, and correcting their intra-DoD Component operational EMC problems. They shall provide feedback from that to the standards, design, concepts, and doctrine, and educational and analytical elements of the EMCP.

(1) (Added)(AF) Under the E³P, HQ AFFMA/SCM, in coordination with Joint Electronic Warfare Center (JEWEC), will develop and implement Air Force-wide procedures to detect, report, solve, and correct operational EMI problems. These procedures will be in AFI 10-707 and will apply to all Air Force MAJCOMs and FOAs.

(2) (Added)(AF) AFMC will provide the POC for EMI and radiation hazard (RADHAZ) reporting and continue funding for the existing quick fix interference reduction capability. This function and capability currently resides at the 1839 EIG, Keesler AFB Mississippi.

(3) (Added)(AF) E³ health hazards are assessed by Bioenvironmental Engineering Services at base level. Expert assistance can be obtained from the Armstrong Laboratory, Brooks AFB Texas.

g. Test and Validation

(1) Development of individual procedures and, as appropriate, in the development of an inter-DoD Component coordinated plan for test and validation in support of the EMCP.

(2) Examining and supporting test validation of the EMC performance of their various telecommunications equipments in joint operational environments, as specified by the CJCS, or designee. This involves a dedicated effort in understanding and/or verifying the equipments' performance due to EMC and EMI factors.

(3) (Added)(AF) AFMC will develop and operate field engineering test facilities to provide measurements of the frequency spectrum-dependent parameters of equipment in its expected environments. It will develop these facilities to permit joint use by other DoD components and will take advantage to the maximum extent possible of existing Air Force and Joint EMC test facilities.

(4) (Added)(AF) Specifically, via the operational requirements validation process, HQ USAF/XO will review and coordinate on proposed system EMC requirements.

(5) (Added)(AF) HQ USAF/TE will, with the assistance of SAF/AQ, HQ USAF/XO, HQ USAF/SC, HQ USAF/IN, AFMC, as well as other MAJCOMs and FOAs, develop the essential test planning to meet developmental needs for the measurement of EMC standards and specifications, frequency spectrum management parameters, and other criteria as necessary to validate that system EMC analyses and predictions will meet operational requirements.

8. (Added)(AF) Responsibilities within the Air Force for management of the E³P.

a. (Added)(AF) AFFMA/SCM is OPR for this supplement and the Air Force E³ program. AFFMA/SCM will represent the Air Force in policy matters pertaining to the proposed Joint E³P, and USMCEB for relating to E³.

b. (Added)(AF) AFFMA will serve as executive agent for E³ activities which may be subdelegated to a MAJCOM. AFFMA is responsible for the EMC review of all Air Force requests for frequency allocation and assignment, and to represent the Air Force concerning EMC matters in the Interdepartmental Radio Advisory Committee, the USMCEB permanent working groups, and other fora as outlined in AFI 33-106, volume 9.

c. (Added)(AF) AFMC will provide a POC for the Air Force E³P, and provide an annual budget for its administration. The POC and management may be subdelegated to one or more subordinate units.

d. (Added)(AF) Rome Laboratory/ERPT is responsible for providing Air Force capabilities for simulation and assessment of electromagnetic performance of systems, equipments, and components in their intended nonnuclear electromagnetic environments under project HAVE NOTE.

e. (Added)(AF) All Air Force MAJCOMs and FOAs are required to participate in the E³P to the extent that they impact Global Force - Global Reach. The E³ concept is essential to all ground, air, and space electrical, electronic, and telecommunications equipment that will participate in the DoD's combat capability and will deploy to the combat theater or area of responsibility (AOR).

F. RELATIONSHIPS

1. **Other Government Agencies and the Civilian Community.** EMC problems are common to all users of the EM spectrum. A successful program must consider and serve all who use telecommunications equipment. Within the constraints of national security, and fund or facility availability, the capabilities attained under this EMCP may be made available to non-DoD Components; e.g., the National Telecommunications and Information Administration (NTIA), the Federal Communications Commission (FCC), and other Government Agencies; the International Telecommunications Union (ITU); and the civilian community. The "Manual of Regulations and Procedures for Federal Radio Frequency Management" (reference (f)) gives the interrelationships among the Department of Defense, NTIA, FCC and ITU. (Added)(AF) E³ objectives must be considered during all phases of equipment planning, research, development, acquisition, logistic support, deployment and operation. Each organization and each person who participates in the generating of operational requirements, system design, development, testing, acquisition (purchase), logistic support and operation of Air Force electrical, electronic, or telecommunications equipment must consider the requirement to achieve control of EMI in the AOR as given below:

a. (Added)(AF) State applicable E³ objectives as an integral part of an operational requirement.

b. (Added)(AF) Give appropriate E³ objectives consideration in new equipment design.

c. (Added)(AF) Develop plans for testing of existing equipment for appropriate E³ objectives and budget to modify equipment to correct EMC problems.

d. (Added)(AF) Give E³ objectives consideration in the purchase and use of standard or NDI equipment.

e. (Added)(AF) Apply EMC and spectrum engineering techniques to deployment planning activity while considering factors which include national and international constraints.

f. (Added)(AF) Make site EMC surveys before installing ground equipment at home base or deploying existing equipment to the AOR.

2. Electronic Countermeasures (ECM), Electronic Counter-Countermeasures (ECCM), Electronic Combat (EC), EM effects, EM Pulse (EMP), and Radiation Hazards (RADHAZ) Programs. Those programs are specific aspects of the use of or defense against effects of EM radiations. Their existence, as separate programs, is predicated on either military requirements or on overriding urgency due to danger to personnel. As the EMCP progresses, it should augment, be used by, and in some instances, be integrated with those programs. Advances in EMC that are based upon basic advances in EM technology should be shared among applicable programs. As a minimum, other DoD programs shall be so conducted that equipments and systems developed for their special purposes shall meet all applicable EMC standards of conventional telecommunications equipments, subsystems, and systems. The EMC community should be alert also for techniques developed in other programs that have general application (i.e., ECCM techniques that may also be effective against unintentional interference). (Added)(AF) Objectives of the Air Force E³P are:

a. (Added)(AF) Throughout the life cycle of ground, air, and space electrical, electronic, and telecommunications equipments and systems, to address considerations for control of EMI to acceptable levels when operated in the AOR under combat conditions. These considerations include, but are not limited to, spectrum management, EMC engineering for EMI control, out-of-band effects of friendly ECM, hardening for enemy electromagnetic pulse (EMP) and high power microwave (HPM) weapons, and EMI effects on Electro-Optic and infra-red laser systems.

b. (Added)(AF) To maximize EMC and minimize RADHAZ of ground, air, and space electrical, electronic, and telecommunications equipment, subsystems, and systems when operated by components of the Air Force in the intended environment. E³ and RADHAZ analysis, will normally be based on operational scenarios representative of the intended operation of the subsystem, system, or equipment involved, such as the deployment missions of an Air Force composite wing.

c. (Added)(AF) To attain built-in, operationally-required, EMI and EMP hardening at the earliest practical portion of equipment's or platform's life cycle.

d. (Added)(AF) To foster within the Air Force common DoD-wide philosophies, approaches, and techniques in the concept formulation, design, RDT&E, analysis, production, and operational phases of ground, air, and space electrical, electronic, and telecommunications equipment to control EMI in the intended operational environment.

e. (Added)(AF) To integrate EMC, EMI control, and spectrum management into C3CM doctrine to enhance Air Force capability to exploit or counter the potential effects of both friendly and enemy electromagnetic emissions on Air Force operations, equipment, and personnel.

f. (Added)(AF) Ultimately, to strive to acquire ground, air, and space electrical, electronic and telecommunications systems that can be operated in an electromagnetically compatible manner, on intended or unintended platforms, and be successfully deployed worldwide to support Global Force--Global Reach.

CARL G. O'BERRY, Lt General, USAF
DCS/Command, Control, Communications, and Computers

(Added)(AF) Attachments

1. Terms Explained
2. Related Documents for the Air Force E³ Program

(ADDED)(AF) TERMS EXPLAINED

Area of Responsibility. A defined area of land in which responsibility is specifically assigned to the commander of the area for the development and maintenance of installations, control of movement, and the conduct of tactical operations involving troops under his control along with parallel authority to exercise these functions. (Joint Pub 1-02)

Command, Control, Communications Countermeasures. The integrated use of operations security, military deception, psychological operations, electronic warfare and physical destruction, mutually supported by intelligence, to deny information to, influence, degrade, or destroy adversary command and control capabilities against such actions. Command and control warfare applies across the operational continuum and all levels of conflict. Also called C2W. C2W is both offensive and defensive.

a. **Counter-C2.** To prevent effective C2 of adversary forces by denying information to, influencing, degrading, or destroying the adversary c2 system.

b. **C2 Protection.** To maintain effective command and control of own forces by turning to friendly advantage or negating adversary efforts to deny information to, influence, degrade or destroy the friendly C2 system. (CJCS MOP 6)

Directed-Energy Warfare (DoD). Military action involving the use of directed-energy weapons, devices, and countermeasures to either cause direct damage or destruction of enemy equipment, facilities, and personnel, or to determine, exploit, reduce, or prevent hostile use of the electromagnetic spectrum through damage, destruction, and disruption. It also includes actions

taken to protect friendly equipment, facilities, and personnel and retain friendly use of the electromagnetic spectrum. Also called DEW.

Electromagnetic Compatibility. The ability of systems, equipment, and devices that utilize the electromagnetic spectrum to operate in their intended operational environments without suffering unacceptable degradation or causing unintentional degradation because of electromagnetic radiation or response. It involves the application of sound electromagnetic spectrum management; system, equipment, and device design configuration that ensures interference-free operation; and clear concepts and doctrines that maximize operational effectiveness. Also called EMC. (CJCS MOP 6)

Electromagnetic Environment (DoD). The resulting product of the power and time distribution, in various frequency ranges, of the radiated or conducted electromagnetic emission levels that may be encountered by a military force, system, or platform when performing its assigned mission in its intended operational environment. It is the sum of electromagnetic pulse; hazards of electromagnetic radiation to personnel, ordnance, and volatile materials; and natural phenomena effects of lightning and p-static. Also called EME. (Joint Pub 1-02)

Electromagnetic Environmental Effects (DoD). The impact of the electromagnetic environment upon the operational capability of military forces, equipment, systems, and platforms. It encompasses all electromagnetic disciplines, including electromagnetic compatibility and electromagnetic interference; electromagnetic vulnerability; electromagnetic pulse; electronic counter-countermeasures, hazards of electromagnetic radiation to personnel, ordnance, and volatile materials; and natural phenomena effects of p-static. Also called E3. (Joint Pub 1-02)

Electromagnetic Interference (DoD). Any electromagnetic disturbance that interrupts, obstructs, or otherwise degrades or limits the effective performance of electronics/electrical equipment. It can be induced intentionally, as in some forms of electronic warfare, or unintentionally, as a result of spurious emissions and responses, intermodulation products, and the like. Also called EMI. (Joint Pub 1-02)

Electromagnetic Pulse. The electromagnetic radiation from a nuclear explosion caused by Compton-recoil electrons and photoelectrons from photons scattered in the materials of the nuclear device or in a surrounding medium. The resulting electric and magnetic fields may couple with electrical or electronic systems to produce damaging current and voltage surges. May also be caused by nonnuclear means. (JCS Pub 1)

Electromagnetic radiation hazards (DoD). Hazards caused by a transmitter/antenna installation that generates electromagnetic radiation in the vicinity of ordnance, personnel, or fueling operations in excess of established safe levels or increases the existing levels to a hazardous level; or a personnel, fueling, or ordnance installation located in an area that is illuminated by electromagnetic radiation at a level that is hazardous to the planned operations or occupancy. These hazards will exist when an electromagnetic field of sufficient intensity is generated to: a. Induce or otherwise couple currents and/or voltages of magnitudes large enough to initiate electroexplosive devices or other sensitive explosive components of weapon systems, ordnance, or explosive devices. B. Cause harmful or injurious effects to humans and wildlife. c. Create sparks having sufficient magnitude to ignite flammable mixtures of materials that must be handled in the effected area. (Joint Pub 1-02)

High Power Microwave. Received levels of microwave energy that are sufficient to cause permanent and irreversible damage to electronic components. (JCS Pub 1)

(ADDED)(AF) RELATED DOCUMENTS FOR THE AIR FORCE E³ PROGRAM

AFCAT 36-2223, *USAF Formal Schools (Policy, Responsibilities, General Procedures, and Course Announcements)*

AFI 10-206, *Reporting Instructions* (formerly AFR 55-55)

AFI 10-701, *Performing Electronic Attack in the United States and Canada* (formerly AFR 55-44)

AFI 10-707, *Spectrum Interference Resolution* (formerly AFR 55-3)

AFI 33-106, volume. 9, *Radio Frequency Spectrum Management* (formerly AFR 700-14)

AFI 36-2201, *Developing Military Training Programs* (formerly AFR 50-9)

AFI 60-101, *Standardization* (formerly AFR 73-1)

AFI 63-101, *Acquisition System* (formerly AFR 800-1)

AFI 91-204, *Investigating and Reporting US Air Force Mishaps* (formerly AFR 127-4)

AFI 99-101, *Developmental Test and Evaluation* (formerly AFR 80-14)

AFMD 25, *Air Force Frequency Management Agency*

AFR 57-4, *Modification Program Approval* (No former publication)

AFOSH Standard 161-9, *Exposure to Radio Frequency Radiation*

DoD Directive 3222.3, *Department of Defense Electromagnetic Capability Program*, August 20, 1990

DoD Directive 4650.1, *Management and Use of the Radio Frequency Spectrum*, June 24, 1987

DoD Directive 5000.1, *Defense Acquisition*, February 23, 1991

DoD Instruction 5000.2, With Change 1, *Defense Acquisition Management Policies and Procedure*, February 23, 1991

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